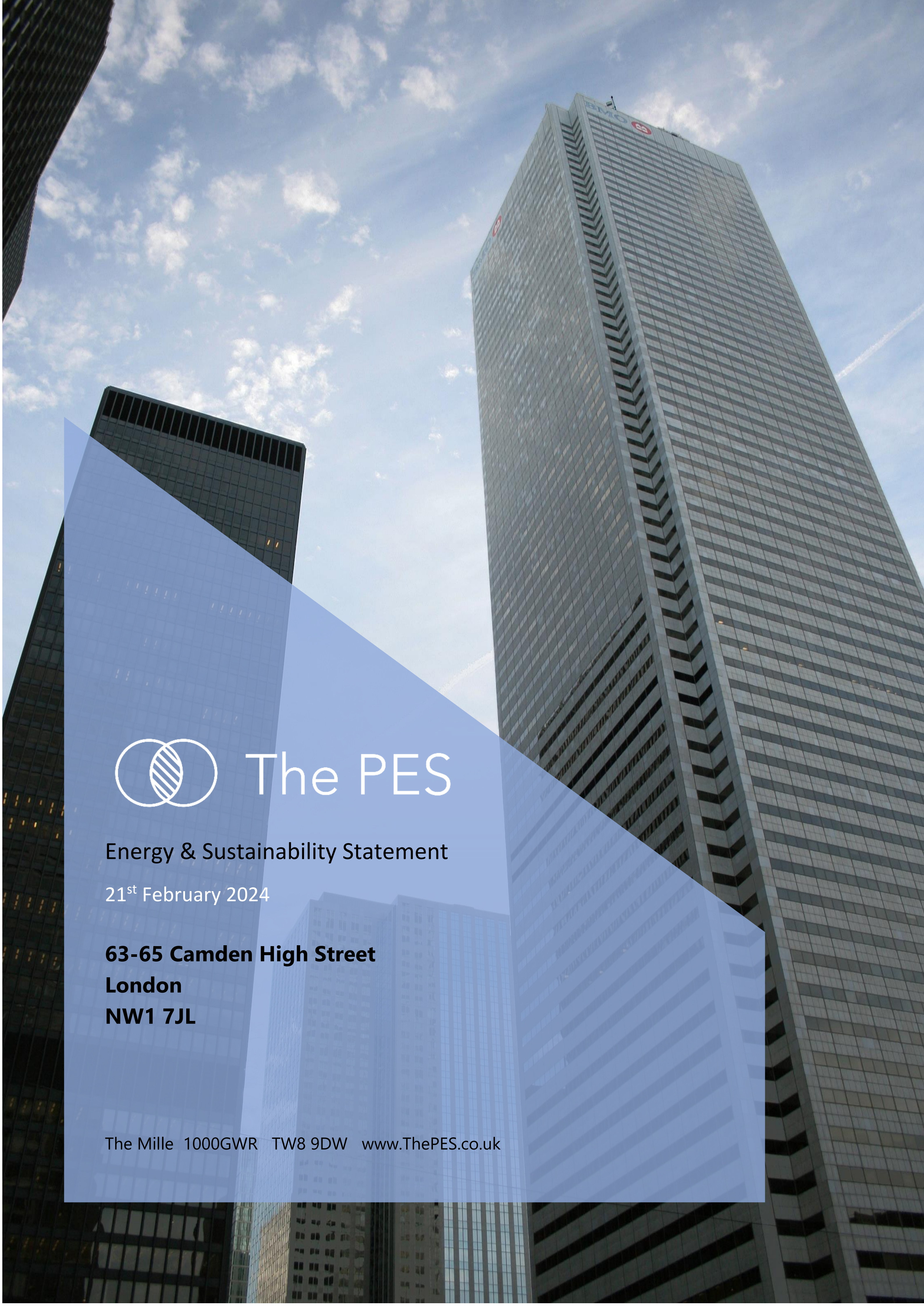


The PES

Energy & Sustainability Statement

21st February 2024

63-65 Camden High Street
London
NW1 7JL

The Mille 1000GWR TW8 9DW www.ThePES.co.uk

The PES

Contents

Appendices

1.0 Executive Summary

The proposed development project at 63-65 Camden High Street involves the change of use, refurbishment and extension of an existing commercial premises to create 9 new dwellings.

It has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by the London Plan and the London Borough of Camden's Local Plan policies.

A 'Lean, Clean, Green' approach to assessing energy and thermal comfort needs and appropriate solutions has been adopted following the guidance under Chapter 9 of the London Plan and the latest GLA guidance on the preparation of energy statements (June 2022) the development achieves an overall improvement (BER/TER) in regulated emissions of **85.4**% over the Part L 2021 standard and a reduction in overall emissions at **73.4%** when taking into account unregulated energy use, through the adoption of high standards of insulation, heating and domestic hot water generated by heat pump technology and a roof mounted PV array.

2.0 The Site & Proposal

The application site is located to the west side of Camden High Street, currently occupied by a 4 storey commercial premises.

The project is for the change of use and conversion of the 3 upper floors to create 7 x new flats, with a roof top extension creating 2 x new build flats.

2.1 Local Planning Context

The project sits within the London Borough of Camden (Camden).

Camden's Local Plan was adopted in July 2017

Chapter 8 deals with matters of sustainability and climate change:-

Policy CC1 Climate change mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f. expect all developments to optimise resource efficiency.

Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;

b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

In January 2012, Camden introduced Planning Guidance - Energy efficiency and Adaptation, offering further guidance on the development of energy strategies.

2.2 The London Plan

Chapter 9 deals with Sustainable Infrastructure:-

Policy SI2 Minimising greenhouse gas emissions

A Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1) Be lean: use less energy and manage demand during construction and operation.
2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
3) Be green: generate, store and use renewable energy on-site.

B Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

1) through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
2) off-site provided that an alternative proposal is identified and delivery is certain.

Policy SI3 Energy infrastructure

D Major development proposals within Heat Network Priority Areas should have a communal heating system

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks

b) use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
c) generate clean heat and/or power from zero-emission sources
d) use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
e) use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
f) use ultra-low NOx gas boilers.

2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.
3) Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

Policy SI4 Managing heat risk

A Development proposal should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1) minimise internal heat generation through energy efficient design
2) reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls
3) manage the heat within the building through exposed internal thermal mass and high ceilings
4) provide passive ventilation
5) provide mechanical ventilation
6) Provide active cooling systems.

Policy SI5 Water infrastructure

C Development proposals should:

1) minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)
2) achieve at least the BREEAM excellent standard (commercial development)
3) be encouraged to incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future proofing.

Policy SI12 Flood risk management

C Development proposals which require specific flood risk assessments should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Where possible, development proposals should set permanent built development back from flood defences to allow for any foreseeable future upgrades.

Policy SI13 Sustainable Drainage

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1) rainwater harvesting (including a combination of green and blue roofs)
2) infiltration techniques and green roofs
3) rainwater attenuation in open water features for gradual release
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) rainwater attenuation above ground (including blue roofs)
6) rainwater attenuation below ground
7) rainwater discharge to a surface water sewer or drain
8) rainwater discharge to a combined sewer.

C Development proposals for impermeable paving should be refused where appropriate, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that address issues of water use efficiency, river water quality, biodiversity, amenity and recreation.

It is noted that the proposed domestic development is less than 10 units and would be considered non-major development.

In line with the latest GLA guidance, the design team have progressed this assessment based upon the Part L 2021 calculation methodology following the latest GLA guidance.

The GLA Part L 2021 reporting tool is attached at **Appendix D**.

3.0 Baseline energy results

The first stage of the Mayor's Energy Hierarchy is to consider the baseline energy model.

The following section details the baseline energy requirements for the development – the starting point when considering the energy hierarchy.

3.1 New Build Dwellings

The baseline emission levels – the Target Emission Rate (TER) - is obtained by applying the design to a reference 'notional' building the characteristics of which are set by regulations – SAP10.2; The new Part L Building Regulations 2021 came into force in June 2022 and introduced a completely new notional dwelling as detailed below:-

Table 1.1 Summary of notional dwelling specification for new dwelling[1]

Element or system	Reference value for target setting
Opening areas (windows, roof windows, rooflights and doors)	Same as for actual dwelling not exceeding a total area of openings of 25% of total floor area[2]
External walls including semi-exposed walls	$U = 0.18\ W/(m^2K)$
Party walls	$U = 0$
Floors	$U = 0.13\ W/(m^2K)$
Roofs	$U = 0.11\ W/(m^2K)$
Opaque door (less than 30% glazed area)	$U = 1.0\ W/(m^2K)$
Semi-glazed door (30–60% glazed area)	$U = 1.0\ W/(m^2K)$
Windows and glazed doors with greater than 60% glazed area	$U = 1.2\ W/(m^2K)$ Frame factor = 0.7
Roof windows	$U = 1.2\ W/(m^2K)$, when in vertical position (for correction due to angle, see specification in SAP 10 Appendix R)
Rooflights	$U = 1.7\ W/(m^2K)$, when in horizontal position (for correction due to angle, see specification in SAP 10 Appendix R)
Ventilation system	Natural ventilation with intermittent extract fans
Air permeability	$5\ m^3/(h \cdot m^2)$ at 50 Pa
Main heating fuel (space and water)	Mains gas
Heating system	Boiler and radiators Central heating pump 2013 or later, in heated space Design flow temperature = 55 °C
Boiler	Efficiency, SEDBUK 2009 = 89.5%
Heating system controls	Boiler interlock, ErP Class V Either: – single storey dwelling in which the living area is greater than 70% of the total floor area: programmer and room thermostat – any other dwelling: time and temperature zone control, thermostatic radiator valves
Hot water system	Heated by boiler (regular or combi as above) Separate time control for space and water heating
Wastewater heat recovery (WWHR)	All showers connected to WWHR, including showers over baths Instantaneous WWHR with 36% recovery efficiency utilisation of 0.98
Hot water cylinder	If cylinder, declared loss factor = $0.85 \times (0.2 + 0.051\ V^{2/3})$ kWh/day where V is the volume of the cylinder in litres
Lighting	Fixed lighting capacity (lm) = 185 × total floor area Efficacy of all fixed lighting = 80 lm/W
Air conditioning	None
Photovoltaic (PV) system	For houses: kWp = 40% of ground floor area, including unheated spaces / 6.5 For flats: kWp = 40% of dwelling floor area / (6.5 × number of storeys in block) System facing south-east or south-west

NOTE:
1. For a dwelling connected to an existing district heat network, an alternative notional building is used. See paragraph 1.8 and SAP 10.
2. See SAP 10 for details.

SAP first creates the notional reference building, based upon the same shape and form as the proposed dwelling and applies the above the characteristics as defined in SAP10.2, prior to applying the actual construction and HVAC solution of the proposed dwellings to generate the Dwelling Emission Rate (DER).

3.2 Dwelling Created via Refurbishment/Extension

For dwellings created via change of use, the SAP methodology is used, but the notional baseline dwelling is set following the GLA guidance within Appendix 3, Table 12 – as set out below:-

Table 12: *Residential notional specification for existing buildings*

Element	Unit	Specification[3]
External Wall – cavity insulation	W/m^2K	0.55
External Wall – internal or external insulation	W/m^2K	0.30
Roof	W/m^2K	0.16
Floor	W/m^2K	0.25
Glazing	W/m^2K	1.60
Vision element	g-value	0.63
Air permeability	($m^3/h\ m^2$ @ 50 Pa)	Default - determined by fabric element types
Thermal Bridging	W/m^2K	Default
HVAC type	-	As per final building specification
Heating and Hot Water	Per cent	Efficiencies to match the applicable notional values for existing dwellings (see section 6 of Approved Document L1)
Cooling (air-condition)	SEER	None
Lighting	Per cent	100 per cent low energy lighting with a minimum luminous efficacy of 75 light source lumens per circuit-watt.

Once all of the baseline emission rates have been calculated in line with the above Government approved methodologies, they are considered as stage 'zero' of the energy hierarchy as described earlier and Target Emission Rate sets the benchmark for the worst performing, but legally permissible, development.

For the project at Camden High Street, a sample of 3 units – 2 x conversions and 1 x new build - has been selected to accurately reflect the performance of the overall project

3.2 Unregulated Energy Use

The baseline un-regulated energy use for cooking & appliances in the residential units have been calculated using the SAP Section 16 methodology; the same calculation used for Code for Sustainable Homes (CfSH) Ene 7.

Appliances = E_A = 207.8 X (TFA X N)$^{0.4714}$

Cooking = (138 + 28N)/TFA

N = no of occupant SAP table 1B

TFA – Total Floor Areas

Table 1 – Unregulated Energy Use

Unit	Unregulated Energy Use Kg/sqm
Unit 4	125
Unit 5	125
Unit 9	169

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated under 3.1 above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Camden policies.

3.3 Baseline Results

The baseline building results have been calculated and are presented in Table 2 below. The Baseline SAP TER outputs, which summarise the key data are attached at **Appendix A**. The GLA Part L 2021 reporting spreadsheet is attached at **Appendix D.**

Table 2 – Baseline energy consumption and CO_2 emissions

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Unit 4	3,711	125	3,836
Unit 5	3,685	125	3,810
Unit 9	3,673	169	3,842
Development Total	**11,069**	**1,817**	**12,886**

4.0 Design for energy efficiency

The first step in the Mayor's 'Energy Hierarchy' as laid out in Chapter 9 of The New London Plan, requires that buildings be designed to use improved energy efficiency measures – Be Lean. This will reduce demand for heating, cooling, and lighting, and therefore reduce operational costs while also minimizing associated carbon dioxide emissions.

This section sets out the measures included within the design of the development, to reduce the demand for energy, both gas and electricity (not including energy from renewable sources). The table at the end of this section details the amount of energy used and CO_2 produced by the building after the energy efficiency measures have been included. From these figures the overall reduction in CO_2 emissions, as a result of passive design measures, can be calculated. To achieve reductions in energy demand the following measures have been included within the design and specification of the building:

4.1 Passive Design

Local and London Plan policy requires designers to introduce measures to control heat gain and deliver passive cooling.

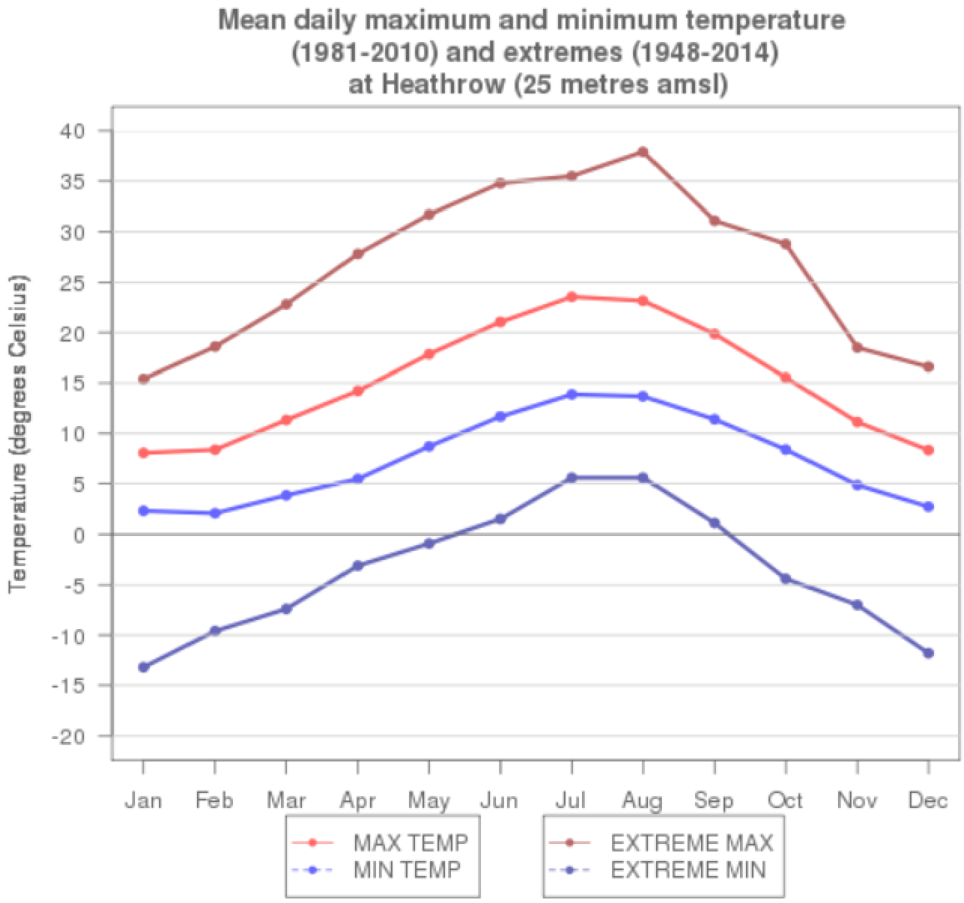
It is further explained that; "the NPPF emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today."

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning.

Accordingly, careful consideration of this issue has been undertaken as part of the application for renewal. The applicants will seek to follow the guidance within CIBSE Guide A and KS03 – Sustainable Low Energy Cooling; An Overview in order, where practical and feasible, to deliver a passive cooling strategy.

4.1.1 Local Environment

The project is located in London. Mean daily maximum temperatures range from just over 6 °C to 8 °C during the winter months and from 20 °C to 23 °C in the summer. These are comparable with typical values found in the summer in the London area which tends to be the warmest part of the UK. Thus, the area is not vulnerable to temperature extremes.



Across the region, sunshine annual averages 1600 hours in the London area, just above the UK average, while much of southern England receives less than 700 mm per year and includes some of the driest areas in the country.

The location in a relatively low rise suburban location and is not expected to suffer localised impacts of excessive urban heat island effect or elevated wind speeds.

4.1.2 Passive Design

In line with current GLA Guidance, the project at Camden High Street has had been designed to ensure the building is not vulnerable to overheating; to instigate consideration of the risk of overheating with the proposed development, the design team have followed the guidance within the London Plan, which consider the control of overheating using the Cooling Hierarchy:-

1. **minimise internal heat generation through energy efficient design**

The project will be designed to best practice thermal insulation levels as noted, full details of which are noted under 4.3 below.

Not only does good insulation assist in reducing heat losses in the winter, but it also has a significant impact on preventing heat travelling through the build fabric during the summer.

2. **reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and wall**

The development site is located on a north east facing plot with aspects to the south west within an area of mid-rise city suburban townscape. As a refurbishment and extension project orientation is fixed.

There will be significant topographical solar shading to the south east from the existing properties on Camden High Street.

The livings areas have the benefit of large, glazed areas introducing natural daylight and attracting useful solar gain.

These same large, glazed area are afforded protection from excessive solar gain during as a natural consequence of the project orientation, away from the key southern aspect.

Across the scheme, the glazing to the secondary spaces – bedrooms and bathrooms – are reduced glazing in keeping with the reduced heat demand associated.

Glazing specification has been a significant consideration as part of the overheating risk mitigation and the specified new glazing will achieve a low g-value at circa 0.5 in order to further assist in reducing overheating risk from excessive solar gain.

3. **manage the heat within the building through exposed internal thermal mass and high ceilings**

The designed floor/ceiling heights are at circa 2.6m – fixed by the nature of the existing structure – which is of a heavyweight type offering significant thermal mass to offer further internal temperature control.

The new build structure is expected to be a lightweight highly insulated clad construction on a slab floor, again offering the above benefits of significant thermal mass.

4. **passive ventilation**

The majority of the dwellings will be able to cross ventilate and all glazing is designed to have opening areas to introduce high levels of natural "purge" ventilation to further assist in the reduction of overheating risks in appropriate areas.

5. **mechanical ventilation**

Although the strategy above would enable a natural ventilation strategy, however, it is understood that the acoustic environment would preclude such a strategy for all but purge ventilation – so a mechanical system is to be employed

4.2 Heating System

The "notional" heating system considered under the "be lean – use less energy" section of the Energy Hierarchy, will consist of high efficiency gas fired LTHW heating and DHW as set out in the GLA Guidance (June 2022).

- High efficiency boiler – (92.3%+ SEDBUK efficiency) & load compensation.
- Insulated primary pipework

To increase the efficiency in the use of the heating system, the following controls will be used to eliminate needless cycling of the heat pumps.

- Weather and load compensation.

4.3 Fabric heat loss

Insulation measures will be utilised to ensure the calculated U-values exceed the Building Regulations minima, with specific guidance taken from the design team:-

- Existing wall constructions will be internally lined and will target a U-Value of 0.26W/m^{2}k or better.
- New wall constructions will be of a lightweight clad construction and will target a U-Value of 0.14W/m^{2}k or better.
- The new roof will be of a warm roof construction and will meet a U-Value of 0.10W/m^{2}k or better.
- The new ground floor will be insulated under the slab and will target a U-Value of 0.12W/m2k or better.

Air Tightness

- The new dwellings will be air tested to rating at circa 3m^3/hr/m^2, in line with best practice for mechanically ventilated dwellings.

Glazing

- New glazing systems will be triple glazed and achieve a U-Value of 1.0W/m^{2}k, with a g value at circa 0.55 in order to deliver significant solar gain control.

All of the above standards align with the LETI guidance;

LETI (Low Energy Transformation Initiative) is a network of over 1,000 built environment professionals who are working together to put London on the path to a zero carbon future

The guidance document published in 2019 set out performance standards for fabric, operational carbon and embedded carbon to enable new building to contribute the London's emission reduction targets.

4.4 Ventilation

As noted above, the project is to employ a low energy mechanical ventilation strategy, with low specific fans powers and a heat recover efficiencies in excess of 80%.

4.5 Waste Water Heat Recovery

The project will employ waste water heat recovery systems for the showers, which will recover in excess of 45% of the heat from shower wastes that would otherwise be lost.

4.6 Lighting and appliances

The development will incorporate high efficiency light fittings utilising LED lamps, with external lighting controlled by daylight and presence detection to reduce unnecessary use.

Common landing will also employ PIR controls to ensure lighting is not used when not required.

4.7 Energy efficiency results

The above data has been used to update the SAP models the Dwelling Emission Rate outputs of which are attached at **Appendix B**, with the reporting spreadsheet at **Appendix D**.

The following Table 3 shows the emissions levels, as well as the overall emissions from the dwelling.

Table 3 – Energy Efficient emission levels

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Unit 4	1,739	125	1,864
Unit 5	1,734	125	1,859
Unit 9	2,257	169	2,426
Development Total	**5,730**	**1,817**	**7,547**

The results show that the energy efficiency measures introduced have resulted in the reduction in CO_2 emissions from the development by **41.4%.**

Further, the GLA reporting spreadsheet confirms that the passive design/"Be Lean" measures have resulted in a reduction in regulated emissions at **48.2%.**

The total Part L Fabric Energy Efficiency Standard (FEES) for the development – set out in Table 4 below:-

Table 4 – Residential FEES

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (percent)
Development Total	28.65	26.92	6%

5.0 Supplying Energy Efficiently

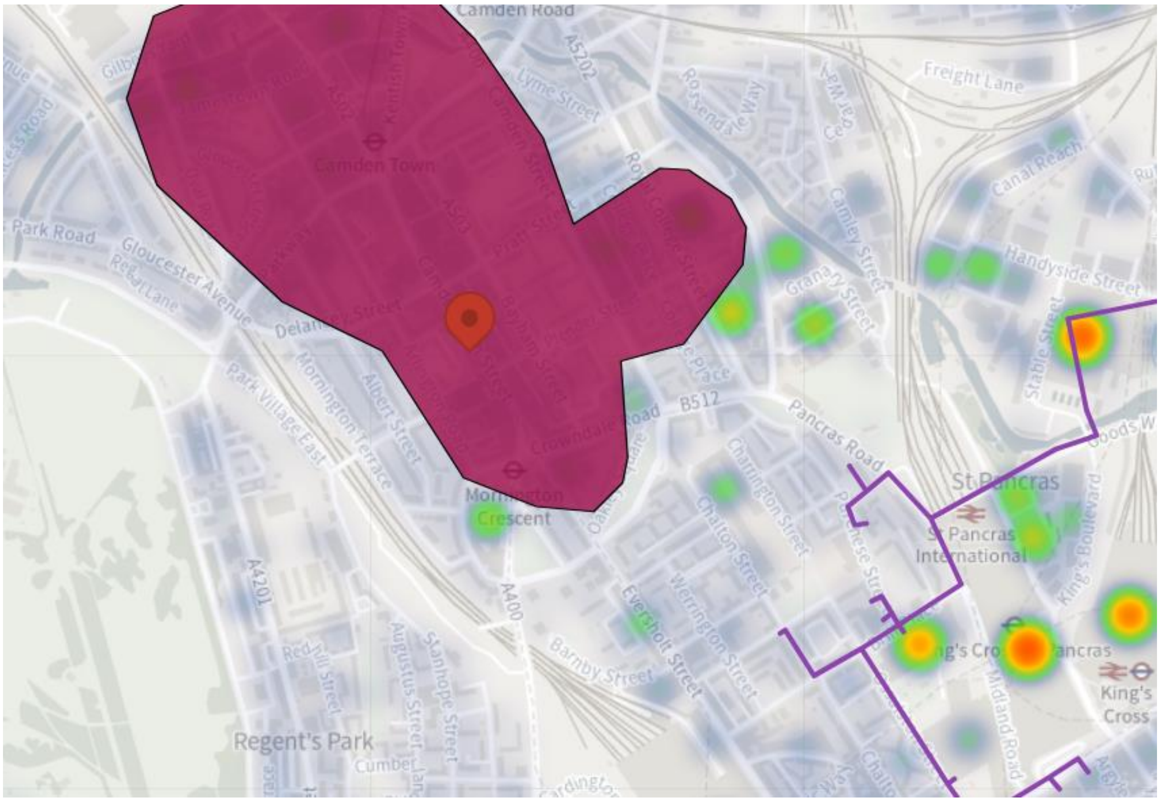
The second stage in the Westminster & Mayor's 'Energy Hierarchy' is to ensure efficient and low carbon energy supply – Be Clean. In particular, this concerns provision of decentralised energy where practical and appropriate.

5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan, Chapter 9, requires that major developments exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

Therefore, this report must consider the availability of heat networks in the local area

The extract from the London Heat Map (reproduced below) indicates that the Camden High Street site is within the Heat Network Priority Area, remote from any existing of proposed DEN, but is within a "high" Potential Heat Network Project Area.



Extract from London Heat Map

As a non-major scheme, there is no obligation to be DEN connection ready; however, the proposed LTHW heating and hot water systems would be DEN connectable, should such a supply become available in the future

In the meantime, we consider the potential for on-site CHP.

5.3 On-site CHP

The heat production facility for a district heating scheme is generally considered to include heat only boilers (HOB) and/or the production of both electricity and heat i.e. CHP.

In order to optimise a CHP system, "sizing" is critical to the success of the project. The aim of the process is to maximise the potential financial savings and ensure compliance with current legislation.

The most important factor is to establish the energy profiles – the site's electrical and thermal characteristics; these can be ascertained by referring to either the site's utility bills or by following dynamic design data for new build projects.

Typically, to get the full environmental and financial benefits, CHP is sized to the heat load of a site. That will recover all of the heat and give the best overall efficiency. Excess electricity generated can be exported or a shortfall in power can be met through a supplier.

To gain a good level of benefit from operating a CHP system, it is advisable that running hours are at least 4,500 hours a year, whilst having a high and constant demand for heat. However, it could still be worth exploring CHP viability for some sites with a low demand for heat if there is a high demand for electrical output, and thereby off-set peak daytime tariffs.

Clearly, in the case of a small residential development with limited year round DHW use, the use of CHP cannot be supported.

6.0 Renewable Energy Options

The final element of the Mayor's 'Energy Hierarchy' requires development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible – Be Green.

Renewable energy can be defined as energy taken from naturally occurring or renewable sources, such as sunlight, wind, wave's tides, geothermal etc. Harnessing these energy sources can involve a direct use of natural energy, such as solar water heating panels, or it can be a more indirect process, such as the use of Biofuels produced from plants, which have harnessed and embodied the suns energy through photosynthesis.

The energy efficiency measures and the sourcing the energy efficiently outlined above have the most significant impact on the heating and hot water energy requirements for the development, and the associated reduction in energy consumption.

It should be noted, that when using SAP10.2 emission factors, each kWh of gas energy saved reduces emissions by 0.21kgCO_2/kWh, whereas, grid based electrical energy has a emissions factor of 0.136kgCO_2/kWh but a much higher cost – some 3.5 that of gas - and accordingly, emphasis will be placed upon "off-setting" grid based electricity in order to achieve the optimum use of renewable technologies, albeit, it should be noted that the emissions reduction impact of renewable technologies actually generating electricity will be considerably reduced.

This section then sets out the feasibility of implementing different energy technologies in consideration of: -

- Potential for Carbon savings
- Capital costs
- Running costs
- Payback period as a result of energy saved/Government incentives
- Maturity/availability of technology
- Reliability of the technology and need for back up or alternative systems.

6.1 Government incentives

6.1.1 Smart Export Guarantee (SEG)

Introduced in 2020, the SEG will enable solar photovoltaic (PV), wind, hydro and anaerobic digestion (AD) installations up to 5MW and micro-combined heat and power (micro-CHP) up to 50kW will be able to receive an export tariff under the policy.

The SEG is a market-led initiative, requiring electricity supply licensees to offer export tariffs to eligible generators. Suppliers are free to set their own SEG compliant tariff price (provided it is above zero pence at all times) and decide how their tariffs work.

Payment are made against metered exports only.

6.1.2 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn for all applications in March 2022.

6.2 Wind turbines

Wind turbines come in two main types'- horizontal axis and vertical axis. The more traditional horizontal axis systems rotate around the central pivot to face into the wind, whilst vertical axis systems work with wind from all directions.

The potential application of wind energy technologies at a particular site is dependent upon a variety of factors. But mainly these are: -

- Wind speed
- Wind turbulence
- Visual impact
- Noise impact
- Impact upon ecology

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. The proposed dwelling is surrounded by buildings of a similar height along, and across Camden High Street. To overcome these potential obstructions and to receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the surrounding buildings and the proposed project at 63-65 Camden High Street itself.

It is inconceivable that any wind turbines of this size would be considered acceptable in this location.

6.3 Solar Energy

The existing building has areas of flat roof - not taken up by terraces and existing plant - that could accommodate solar panels orientated to the south.

In general, the roofs will have an unrestricted aspect, so there is scope therefore to site solar photovoltaic (PV) or water heating equipment at roof level.

6.3.1 Solar water heating

Solar water heating panels come in two main types; flat plate collectors and evacuated tubes. Flat plate collectors feed water, or other types of fluid used specifically to carry heat, through a roof mounted collector and into a hot water storage tank.

Evacuated tube collectors are slightly more advanced as they employ sealed vacuum tubes, which capture and harness the heat more effectively.

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m^2 of unshaded UK roof surface annually. The usable energy output per m^2 of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing gas or high efficiency heat pumps for DHW provision; accordingly solar thermal systems tend to have a very poor pay back model.

Accordingly, given the limited roof space available and the strategy to off-set the electrical use, solar PV may be a stronger candidate (see below) and offer a greater return in terms of a return on investment.

Accordingly, solar thermal would not be the optimum solution for the proposed development.

6.3.2 Photovoltaics (PV)

A 1kWp (1 kilowatt peak) system in the UK could be expected to produce between 790-800kWh of electricity per year based upon a south east orientation according to SAP2005 methodology used by the Microgeneration Certification Scheme (MCS). The figure given in the London Renewables Toolkit is 783 kWh per year for a development in London.

Despite the withdrawal of the Feed in Tariff, PV panels also offer an attractive return due to the ever increasing cost of grid based electricity.

The design team are proposing the use of PV - a 16 panel array – a 7.04kWp array generating some 6,000kWh/annum.

6.4 Biomass heating

Biomass is a term given to fuel derived directly from biological sources for example rapeseed oil, wood chip/pellets or gas from anaerobic digestion. It can only be considered as a renewable energy source if the carbon dioxide emitted from burning the fuel is later recaptured in reproducing the fuel source (i.e. trees that are grown to become wood fuel, capture carbon as they grow).

Biomass heating systems require space to site a boiler and fuel hopper along with a supply of fuel – which can be very bulky items. There also needs to be a local source of biomass fuel that can be delivered on a regular basis. There are also issues with fuel storage and delivery which mitigate against this technology.

Traditionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions and particulate matters, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements the London boroughs; indeed, the whole of the Camden is a designated air Quality Management Area. Accordingly, the use of biomass is not considered appropriate for this project.

6.5 Ground source heat pump

All heat pump technologies utilise electricity as the primary fuel source – in this case displacing gas, as such, the overall reduction in emissions when using this technology can be less effective when opposed to a technology that is actually displacing electricity.

Ground source heating or cooling requires a source of consistent ground temperature, which could be a vertical borehole or a spread of pipework loops and a 'heat pump'. The system uses a loop of fluid to collect the more constant temperature in the ground and transport it to a heat pump. In a cooling system this principle works in reverse and the heat is distributed into the ground.

The heat pump then generates increased temperatures by 'condensing' the heat taken from the ground, producing hot water temperatures in the region of 45°C. This water can then be used as pre-heated water for a conventional boiler or to provide space heating with an under floor heating system.

The use of a ground source heating/cooling system will therefore require:

- Vertical borehole or ground loop
- Use of under floor heating
- Space for heat pump unit

Clearly, there is no opportunity to install the required ground collectors, as such, ground source heating cannot be considered.

6.6 Air source heat pump

Air source heating or cooling also employs the principle of a heat pump. This time either, upgrading the ambient external air temperature to provide higher temperatures for water and space heating, or taking warmth from within the building and dissipating it to the outdoor air.

Assuming a seasonal system efficiency of 320% (Coefficient of Performance of 3.2) and that the air source heat pump will replace 100% of the space heating/hot water demand, then the system would reduce the overall CO_2 emissions by approximately 70%. The table below demonstrates, on the assumption of a demand of 1000Kwh/year for heating and hot water.

Table 5 – Air Source Heat Pump Performance

Type of Array	Energy Consumption (kWh/yr.)	Emission factor ($kgCO_2/h$)	Total CO_2 emissions (kg/annum)
90% efficient gas boiler	11111	0.210	2333
320% efficient ASHP	2813	0.136	383
100% efficient immersion (back-up)	1000	0.136	136

A theoretical carbon saving of 77%

With the above data in mind, clearly an ASHP could be an option and the "be green" proposals include the use of air source heat pumps to provide the heat source for the heating and DHW systems

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use of heat pump technology, to provide the required heating and DHW to the new dwellings, as well as the 7.04kWp PV array.

The final table – Table 6 – summarises the final outputs from the SAP models attached at **Appendix C.**

Table 6 – "Be Green" emission levels

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Unit 4	573	125	697
Unit 5	606	125	731
Unit 9	436	169	605
Development Total	**1,614**	**1,817**	**3,431**

The data at Table 6 confirms that overall emissions – including unregulated energy use - have been reduced by **73.4%** over and above the baseline model, with a **31.9%** reduction in emissions directly from the use of energy generating and renewable technologies, i.e. over and above the energy efficient model.

Excluding the un-regulated use, i.e. considering regulated emissions controlled under AD L1, then the final reduction in DER/TER equates to **85.4%.**

Energy use intensities are reported below:-

Table 7 – Energy and Heat Demands

Building Type	Energy Use Intensity ($kWh/m^2/year$)	Space Heating ($kWh/m^2/year$)
Residential	56.66	9.48

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed educational redevelopment are set out below; based on the assessment criteria developed by the Building Research Establishment, specifically:

Materials

The design team have put a strong focus on sustainability and durability when considering construction profiles and building materials for the development. High Green Guide ratings will be achieved wherever possible and materials will be assessed for suitability with regards to Whole Life Costs, which given the use of a retained building, is expected to perform extremely well.

Clearly, the reuse of the existing building - to be extended and improved to enhance useability and thereby, longevity – is clearly and highly sustainable by default.

The principal issue when considering the environmental impact of new construction materials is the embodied carbon – i.e. the carbon cost extraction of raw material, transport to factory, manufacturing, transport to site and erection on site.

Additional carbon costs are occurred through maintenance and repairs as well as end of life (deconstruction/demolition)

The design team will seek out construction techniques with a lower embodied carbon contents; steel work and lightweight concrete floor slabs.

It is recognised that any concrete utilised to form the upper floors has a significant embodied CO2e content, the majority of which comes from the cement, which makes up about 10% of concrete by volume, but accounts for around 75-90% of its embodied impact.

The team will aspire to utilise concrete with a significant recyclable content; concrete with a minim 30% GGBS content; higher if such product can be sourced at the time.

Emissions of CO2 associated with calcium carbonate decomposition during concrete production are partly reversible through carbonation.

The mix design of structural concrete purposefully limits carbonation of the surface layer, preventing corrosion of any embedded steel reinforcement, which might otherwise be affected during the building's life. There is, however, a greater degree of carbonation during the end-of-life stage, when concrete is crushed for reuse as an aggregate. The crushing process substantially increases the material's surface area, allowing CO_2 to be more readily absorbed.

It is generally acknowledged that the concrete carbonisation process will remove up to 30% of the up-front embodied CO2e during the buildings lifespan, including end of life.

Other significant measure considered to reduce the project CO_2e content include:-

- Structural Steels with a 30% recycled content
- Plasterboard with a significant recycled content – subject to market availability

In addition to the above low carbon strategy, the development will source all materials form supplier that can demonstrate that materials are sourced responsibly in line with recognised Environmental Management Systems (FCS, BES6001 etc.)

Insulating materials will be specified to maximise thermal performance whilst still paying attention to the environmental impact of the materials used. The use of recycled products will be pursued wherever feasible and the use of other low embodied energy products will be further investigated.

Non-toxic materials will be used wherever possible, including the specification of products with low VOC content in line with European testing standards.

The principal contractor with be required to produce a site waste management plan and sustainable procure plan, in line with BREEAM guidance – this will include a pre-demolition audit to identify demolition materials to reuse on-site or salvage appropriate materials to enable their reuse or recycling off-site. The procurement plan will follow the waste hierarchy Reduce; Reuse & Recycle.

This will enable targets to set to minimise the generation of non-hazardous construction waste using the sustainable procurement plan to avoid over-ordering and to use just-in-time delivery policies.

Operational waste and recycling – appropriate internal and external storage space will be provided to ensure that residents can sort, store and dispose of waste and recyclable materials in line with Camden’s collection policies.

Pollution

The contractor will also monitor the use of energy and water use during the construction phase and incorporate best site practices to reduce the potential for air (dust) and ground water pollution.

The completed dwelling will use zero emission heat pump systems for heating and hot water.

The main contractor will be required to register the site with the Considerate Constructors Scheme and achieve a best practice score of 25 or more.

To void the issue of noise pollution, the development will comply with Building Regulations Part E, providing a good level of sound insulation between the proposed development and surrounding buildings.

Energy

The development will incorporate renewables technologies as noted in the main report above.

The completed project will be supplied with a Home User Guide offering practical advice on how to run the building economically and efficiently, including specific advice on how to reduce unregulated energy uses.

This will be further enhanced by the installation of smart energy metering, enabling occupiers to accurately assess their energy usage and thereby, manage it.

Water

The development minimise water use as far as practicable by incorporating appropriate water efficiency and water recycling measures. The use of low flow taps, showers and low capacity baths and WCs will be sourced in order to achieve a daily water use rate at less than 105l/person.

Sustainable Urban Drainage (SuDs)

The existing site is currently made up building and hard surfaces. Accordingly, the introduction of attenuation measures will help to reduce the levels of surface water run-off.

A formal SuDs strategy is submitted under separate cover

Ecology and Biodiversity

Clearly, the existing site is nearly 100% previously developed, so the applicants seek an improvement on this situation would increase biodiversity.

The development would employ an ecologist to consider the planting regime for the communal landscaped areas and an overall improvement in the levels of fauna and flora utilising indigenous species where possible and appropriate.

8.0 Conclusions

This report has detailed the baseline energy requirements for the proposed Camden High Street development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO_2 reductions using renewable energy technologies.

Throughout the assessment against the energy hierarchy – as set out in The London Plan – SAP10.2 emissions data has been used in line with the very latest GLA guidance on the preparation of energy statements.

The baseline results have shown that if the dwelling was built to a standard to meet only the minimum requirements of current building regulations, the total amount of CO_2 emissions would be **12,886Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO_2 emissions would be reduced to **7,547Kg/year**

There is also a requirement to reduce CO_2 emissions across the development using renewable or low-carbon energy sources. Therefore the report has considered the feasibility of the following technologies:

- Wind turbines
- Solar hot water
- Photovoltaic systems
- Biomass heating
- CHP (Combined heat and power)
- Ground & Air source heating

The results of the assessment of suitable technologies relative to the nature, locations and type of development suggest that the most suitable solution to meeting reduction in CO_2 emissions would be via the use of heat pump technology to service the heat and DHW demand, supplemented by a 7.04kWp PV array.

This has been used in the SAP models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 6, which show a final gross emission level of **3,431Kg/year**, representing a total reduction in emissions over the baseline model, taking into account unregulated energy, of **73.4%.**

In addition, the final SAP outputs at **Appendix C** demonstrate that the building achieves an overall improvement in emissions over the Building Regulations Part L standards for regulated emissions of minimum of **85.4%**.

Tables 6 & 7 Demonstrate how the 63-65 Camden High Street project complies with the London Plan requirements and the GLA guidance relating to zero carbon development.

Table 6 – Carbon Emission Reductions – Domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	11.1
CO2 emissions after energy demand reduction (be lean)	5.7
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	5.7
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	1.6

Table 7 – Regulated Emissions Savings – Domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	5.3	48%
Savings from renewable energy	4.1	37%
Total Cumulative Savings	9.5	**85%**
	(Tonnes CO_2)	
Carbon Shortfall	1.6	
Cumulative savings for off-set payment	**48**	
Cash-in-lieu Contribution	**£N/A**	

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Target Emission Rates

Appendix B

Energy Efficient Design:-

SAP Dwelling Emission Rate

Appendix C

Generating energy on-site:-

Final SAP Dwelling Emission Rate

Appendix D

GLA SAP201 Reporting Tool